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AUTHOR Pomerantz, David J.
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ABSTRACT

In an on-going pilot study, training procedures previously found successful with moderately and severely retarded adolescents and adults have been adapted to teaching trainable retarded children (6-, 8-, and 10-years-old) to assemble a 14-piece coaster brake. Modifications in the carefully detailed task analysis approach have included the need for new formats and feedback strategies. Preliminary data indicates a slow but regular rate of progress in the Ss' skill acquisition. (CL)

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# MANUAL SKILL TRAINING OF RETARDED CHILDREN

David J. Pomerantz

Children's Research Center
University of Illinois at Urbana-Champaign
51 Gerty Drive
Champaign, Illinois 61820

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This paper describes a series of studies which is still in an early stage of development. The purpose of the research is to adapt training procedures previously used with moderately and severely retarded adolescents and adults (Gold, 1972) for use with trainable children. The studies are conceived as an initial step toward experimental investigation of issues associated with prevocational skill training.

Two general attitudes underlie an endeavor of this nature. Firstly, we recognize the primary importance of a technology of training developed from basic and applied research. Data from such research can provide educative agencies with the instructional expertise required to give to the severely handicapped the skills they will need to live with dignity within their home communities. The second philosophical foundation of our work is a bit more disturbing. Developing effective ways of teaching the retarded is not in itself an adequate strategy for solving their problems. In fact, many of these problems can be most meaningfully conceptualized as existing outside of the handicapped individual (Gold, 1975). They are reflected by inappropriately low levels of expectation commonly held in society, and a general tendency to exclude deviant people from the mainstream rather than to adapt to their special needs. If we are to engineer meaningful change, farsighted social action strategies in addition to pedagogic skill is essential.

One such intervention plan focuses on economic reality. If the severely handicapped can be molded into a labor force able to meet industrial demands, the chances would significantly improve for them to be assimilated into the social structure as productive citizens. In the past, our research has attempted to demonstrate the potential of the

retarded for economic viability. The studies have utilized fourteen and twenty-four piece bicycle coaster brakes, as well as electronic circuit board assemblies. These represent considerably more difficult tasks than are usually associated with the severly handicapped, and are therefore useful for demonstrating the large discrepancy between the current level of functioning and unknown potential of retarded persons. The assemblies are also useful as research tools because they have considerable face validity. Watching subjects produce bicycle brakes or circuit boards, one sees a clear example of the retarded engaged in activity that is typically wage-generating.

I became associated with this research project one year ago, because I shared its commitment to the habilitation of the severely handicapped. At that time I expressed interest in expanding its philosophy and technology to incorporate public school curriculum planning and programming. I was struck by the quality of data that had been obtained in the training of unscreened populations. For example, average training time on coaster brakes and circuit boards is under two hours. If moderately and severely retarded individuals could perform at that level after two hours of intervention, what could be done with continuous training over 12 or 15 years? An encouraging trend has developed over the past few years which emphasizes the need for such programming. Society appears to be accepting its responsibility to provide quality services to the severely handicapped and much of this responsibility is being delegated to the public schools (Brown and York, 1974). The clearest indications of change are the judicial and legislative actions of several states guaranteeing to all children the right to public

education (Gilhool, 1973). If economic viability is to be considered a long range objective of educational services, the schools will have to provide a systematic progression of prevocational experiences over an extended period of time. Researchers will have to begin looking at the many unanswered questions associated with prevocational training. What kinds of experiences will be most facilitative for future vocational training and placement? The rapidly changing nature of the vocational structure in a technologically advanced nation, as well as the great degree of variability across work situations make these issues quite complex. Deficiencies in knowledge and experience characterize much of the prevocational area at the present time, and are particularly evident in reference to elementary curricula. Baroff (1974) has proposed a set of basic objectives for elementary pre-vocational programs. These include (1) developing manual skills, (2) making small objects, (3) developing concern for the quality of tasks performed, (4) creating an awareness of the importance of task completion, and (5) strengthening work-related personality characteristics. Although the training described in this paper is conceived as a preliminary search for information and not a prevocational program, it could be considered an appropriate activity for working toward all of these objectives.

The fourteen piece coaster brake has been chosen as the vehicle for our intial exposure to young children. It is considered most likely to provide useful data because it is the task that we know best. This can be clarified by looking at various parameters of the research situation: setting, task, theoretical orientation and population. Our previous research has been conducted in sheltered workshops and institutions.

Training settings have been characterized by individual work with subjects in rooms that are separated from the activity centers of the agencies. Thus, care has been taken to minimize the distractions that commonly occur in teaching situations. The tasks involved can all be characterized as non-verbal and manipulative. Therefore, the training strategy relied more on physical prompts and assistance than verbal feedback. Observers invariably comment on the unusually quiet nature of the sessions. The techniques stress stimulus control and have been powerfully influenced by the Attention Theory of Zeaman and House (1963). However, behavior analysis and methods from industrial engineering and ergonomics are also applied. Until the past few months, subjects were moderately and severely retarded, sighted adolescents and adults. Many other handicaps were encountered, but they were distributed randomly. Staying within these boundaries on setting, task, orientation and population, an encouraging degree of success has been obtained. Within these limits, over 90% of the subjects involved have been able to learn and perform the tasks of interest. A basic question, however, concerns the degree of generalizability of the data. Plans call for gradual expansion of the boundaries to see how widely the techniques and perceptions apply. By altering only one parameter at a time, substantial control can be maintained over the research environment. Observation of an eight year old learning the discriminations and manipulations needed to assemble a bicycle brake immediately generates useful data, because most elements of the situation have been held constant. For now, expansion is viewed in terms of population alone. These pilot studies complement other new efforts with severely retarded blind and deaf-

blind. In the future, the limits of setting, orientation and task must also be enlarged if this research is to provide a knowledge base for a wide variety of prevocational training programs.

The preliminary data to be presented represent an anecdotal account of experiences to date. They are based on only a few subjects, who are 6, 8 and 10 years old and come from the same trainable class. Observations and ideas will be outlined according to the dimensions of a task analysis, which is the tool used for instructional planning. In task analysis, content refers to what the learner does; more specifically it is a breakdown of the behaviors that must be emitted for successful performance of the target skill. The content analysis of manual skills for individuals who are very difficult to train must be detailed, including consideration of such things as finger positions and holds. Process task analysis focuses on the teacher's behavior, and is comprised of a hierarchy of instructional methods, or feedback, that can be used to bring the learner to the target level of performance. Many attempts to train severely handicapped individuals fail because content and process are not differentiated, thereby placing unnecessary demands upon the learner's attention. This is commonly exemplified by teaching programs that confuse the ability to use verbal instructions with the ability to learn the task at hand. Some of the basic issues to be tackled in the pilot studies fall within the content domain of task analysis. Are the steps in the original bicycle brake analysis appropriate for efficient training with the new population? Do young trainable children have the degree of motor control needed for the manipulations demanded in a breakdown that was prepared for older individuals? With the young children in the pilot work, some serious problems have been

observed on certain steps of the assembly. For example, the children have had trouble (1) holding pieces in place and (2) putting the smaller pieces (i.e., nut and cone) straight onto the axle. It appears that much of the difficulty is related to hand size. A coaster brake is a large and relatively heavy collection of metal from the perspective of a small child, and holding it up in a specified position is challenging. Furthermore, as previously indicated, much of the feedback involves physically assisting and molding the learner's hands. It is extremely difficult to place very small fingers into the positions that are most facilitative for each manipulation. Possible solutions to these problems involve changes in the steps of the content task analysis. For example, much of the responsibility for holding the brake can be assumed by the trainer, and gradually programmed back onto into the assembly as subjects' proficiencies develop. Alternatively, a jig (i.e., a board with a hole drilled in it) could be used. Insertion of the axle into the jig would eliminate holding demands and free both hands for manipulative activity. Probably, both kinds of changes will be attempted and assessed for differential effectiveness. Certainly, this kind of data cannot be used to make interpretations about motor control and coordination. What is evident, however, is that some content task analysis changes will be helpful in light of observed differences between severely handicapped adults and children.

Modifications in the process aspects of training will focus on new formats, or sequencing and layout of materials, and feedback strategies. An architectural problem has necessitated the first adaptation in format. We were able to find a table low enough (or chair high enough)

to place subjects in the appropriate position for working at the assembly with a good view of the parts. Smaller subjects are now being trained while sitting on the trainer's lap, which solves the height problem but makes data collection a very complex motor skill. Although less than two weeks old, the learner-on-lap setup has caused surprisingly rapid improvement for two subjects. The crucial difference seems to be a dramatic increase in the trainer's control over the whole situation. For example, Barbara, a six year old, tended to consistently pick up the wrong piece. When she attempted to work it into the assembly, a brief period of chaos ensued before the incorrect part could be replaced. Each trial was, therefore, taking quite a long time to complete, and the number of assemblies that could be attempted per day was limited. Training lacked continuity, and much potential training time was being wasted. With Barbara on the trainer's lap, it is quite simple to anticipate her movements and direct her to pick up the right piece by eliminating alternatives (e.g., covering adjacent pieces as she reaches into the tray). The whole character of the sessions has been altered; she now moves briskly across the board, with time and attention focused on mastering the task. Other format changes designed to increase continuity will be tested with certain subjects. Removing all but one brake from the acquisition tray can control the random grabbing of parts that commonly interrupts the assembly sequence. Another potentially effective method of increasing continuity is the pre-programming of errors during the early stages of training. If pieces were placed uniformly in the tray, in the correct positions to be fit into the assembly, errors and time per trial could be expected to decline significantly. By leaving one or two parts in the wrong positions, the correction

procedure ("try another way") could be retained in the early trials. The meaning of this corrective feedback would be most efficiently taught if these parts involved the easiest discriminations. Gradually, other pieces could be introduced in the wrong positions so that the learner would have to attend to the relevant stimuli dimensions within all parts and make decisions. Eventually, uniformity over assemblies would be faded, leaving a task that involved picking up the parts in order, making two-choice discriminations, and performing the appropriate manipulations.

Training young children may provide interesting and useful information about the feedback process. In our past studies, with older retarded individuals, verbal reinforcement was minimized. This practice represented an attempt to create a social environment appropriate for dignified adults. Also, there is evidence from social reinforcement literature indicating that contingent praise would not be the most effective strategy for teaching manual skills. For example, Paris and Cairns (1972) reported that criticism was far more effective than praise for teaching a discrimination task to retarded children. An observational study designed to clarify this finding indicated that criticism is delivered contingently with greater relative frequency than praise in the classroom. Warren and Cairns (1972) found that the impact of verbal feedback is at least partially determined by its information value. Verbal evaluations will become weak and meaningless unless they convey real information about the quality of performance and the contingencies in effect. Finally, studies of adult non-reaction report that children tend to interpret non-reaction as positive feedback, especially in cases

where it is alternated with critical comments (Spence, 1966, 1970; Hill, Emmerich, Geller, Lazar, and Schickedanz, 1974). Thus, in the training situation described in this paper, the extensive silence should be functioning as positive evaluations. Subjectively, subjects did seem to enjoy the quiet, business-like atmosphere of the research setting. Although trainers were often warned about the severe behavior problems that they would encounter, few serious problems of this nature were actually observed. It is unclear whether this strategy of verbal feedback will be adequate for young children. The first weeks of data provide no clear answer. Several children have fit the pattern of previous studies; their non-attentive, non-compliant classroom behavior is dramatically reversed during training. A few others have been difficult to manage, including one boy who does not stay on task for more than a few minutes and another who is extremely elthargic during training. As the studies progress, close attention will be given to behavior patterns exhibited by the children. If systematic praise or other reinforcers are introduced into the training procedure, effects on inappropriate behavior and learning of the task will be carefully monitored.

The pilot studies are now moving into their third month of operation. Many possibilities for future experimentation have already been indicated. A slow but regular rate of progress has characterized the children's acquisition data, and the outlook for task mastery is excellent for all subjects now involved. The most promising data, however, have been provided by a teacher who observed one of her students working on the bicycle brake. The next day, she had completed a task analysis

of a small assembly for use in prevocational training. She had constructed a cardboard tray so that parts could be placed in sequence, was training students individually, and recording discrimination and manipulation errors on a data form. Within a week she reported that the students were exceeding all of her expectations on this task. Her actions were strongly reinforcing to the researchers, and their rate of activity in the public schools can now be expected to increase.

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